



Tanta University
Faculty of Engineering
Electrical Power and Machines Engineering Department



Electrical Machine (2)
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Sheet (1)

1. A magnetic core carries a flux of $5 \sin 314t$ mWb. Determine the rms value of the induced emf in a 100-turn coil wound on the core using (a) Faraday's law and (b) the transformer equation. If the cross-sectional area of the core is 25 cm^2 , what is the effective flux density in the core?
2. A power amplifier can be represented by a current source in parallel with a 200Ω resistance. An 8Ω loudspeaker is connected to the power amplifier via an audio transformer so that maximum power is transferred to the loudspeaker. What must be the a-ratio of the transformer?
3. A 12-kVA, 480/120-V, step-down ideal transformer is operating at its full load with a 70.7% pf leading. The transformer is designed such that 2 V per turn are induced in its windings. Determine (a) the number of turns in its primary and secondary windings, (b) the primary and secondary winding currents, (c) the power output, and (d) the load impedance on the secondary side. Draw the equivalent circuit by representing the load on the primary side.
4. A 25-kVA transformer has 500 turns on the primary and 50 turns on the secondary. If the primary is rated at 2.5 kV, find the rating of the secondary. What is the flux in the core at no load if the operating frequency is 50 Hz? If the transformer delivers full load at 0.8 pf leading, determine (a) the primary and the secondary winding currents, (b) the power output, (c) the load impedance on the secondary side, and (d) the load impedance as referred to the primary side.
5. A 48-kVA, 4800/480-V, 60-Hz, step-down transformer is supplying a load of 18 kW at the rated voltage and 0.5 pf lagging. Determine the extra load that must be connected to the transformer so that it delivers full load at the rated voltage with unity power factor. If each load consists of a series combination of R, L, and/or C, what are their values?

6. The magnetic flux density in the core of a 4.4-kVA, 4400/440-V, 50-Hz, step-down transformer is 0.8 T (rms). If the induced emf per turn is 10 V, determine (a) the primary and secondary turns, (b) the cross-sectional area of the core, and (c) the full-load current in each winding.

7. An ideal transformer has a 150-turn primary and 750-turn secondary. The primary is connected to a 240-V, 50-Hz source. The secondary winding supplies a load of 4 A at a lagging power factor (pf) of 0.8. Determine (a) the a-ratio, (b) the current in the primary, (c) the power supplied to the load, and (d) the flux in the core.

8. The number of turns in the primary and the secondary of an ideal transformer are 200 and 500, respectively. The transformer is rated at 10 kVA, 250-V, and 60-Hz on the primary side. The cross-sectional area of the core is 40 cm². If the transformer is operating at full load with a power factor of 0.8 lagging, determine (a) the effective flux density in the core, (b) the voltage rating of the secondary, (c) the primary and secondary winding currents, and (d) the load impedance on the secondary side and as viewed from the primary side.

9. A 22-kVA, 2200/1100-V, step-down ideal transformer delivers a rated load at a leading power factor of 0.5. Determine (a) the secondary winding current, (b) the primary winding current, (c) the impedance on the secondary side as a parallel combination of resistance and reactance, and (d) the impedance on the primary side as a series combination of resistance and reactance.

10. A resistive load varies from 1 to 0.5 Ω . The load is supplied by an ac generator through an ideal transformer whose turns ratio can be changed by using different taps as shown in Fig. The generator can be modeled as a constant voltage of 100V (rms) in series with an inductive reactance of $j1\Omega$. For maximum power transfer to the load, the effective load resistance seen at the transformer primary (generator side) must equal the series impedance of the generator, that is, the referred value of R to the primary side is always 1 Ω . (a) Determine the range of turns ratio for maximum power transfer to the load. (b) Determine the range of load voltages for maximum power transfer. (c) Determine the power transferred.